

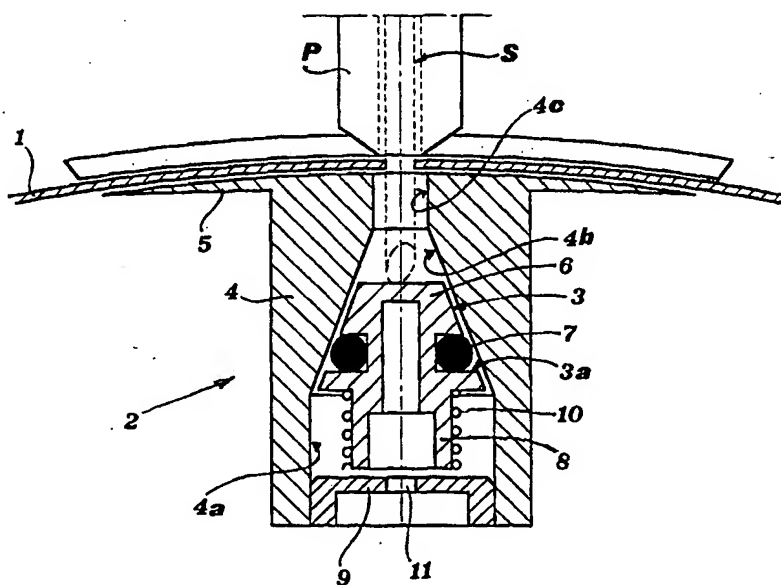


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/IB98/01871 <b>(22) International Filing Date:</b> 25 November 1998 (25.11.98)  <b>(30) Priority Data:</b> MI97U000848      26 November 1997 (26.11.97)      IT  <b>(71) Applicant (for all designated States except US):</b> TERRAGNI, Arnaldo [IT/IT]; Via Italia, 21, I-20037 Paderno Dugnano (IT).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> GIRARDI, Giuseppe [IT/IT]; Via Ticino, 18, I-21043 Catiglionè Olona (IT).  <b>(74) Agents:</b> FAGGIONI, Giovanmaria et al.; Fumero Studio Consulenza Brevetti S.n.c., Via S. Agnese, 12, I-20123 Milano (IT).		<b>(81) Designated States:</b> BR, CN, MX, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Italian).</i>

**(54) Title:** CHECK VALVE FOR INFLATION OF BALLS**(57) Abstract**

The invention relates to a safety valve (2) for inflating playing balls used for games and sports, consisting of a guide body (4) provided with an axial perforation and a valve body (3), movable inside said perforation. The valve body (3) has a frustoconical head (6) able to bear against the walls of a conical middle section (4b) of said axial perforation. Said valve body (3) is movable axially under the action, on the one hand, of the pressure of the inflating air and, on the other hand, of pressure means (10); it also has an annular groove in which O-ring type sealing means are seated.



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## CHECK VALVE FOR INFLATION OF BALLS

The present invention relates to a safety valve for inflating playing balls, in particular balls used for sports activities, such as football, basketball, volleyball, American football and the like, which are made of leather or synthetic material and may or may not have a bladder. Below reference will be made, for the sake of simplicity of the description, to footballs, but it is obvious that the invention is applicable to any other type of ball.

As is known, footballs consist of a casing which is usually made of leather or rubber and is fitted internally with a bladder. Other types of balls, however, in particular those made of rubber, do not have a bladder.

For the purposes of inflation, in most cases, a rubber segment, through which the needle of a special adapter supplying compressed air can pass, is mounted in a relatively small zone within the surface of the ball or the bladder. The casing of the ball has an opening such that this segment is accessible and the segment itself has a small blind receiving hole at the point where the needle of the adapter is to be inserted. The segment can be perforated axially over a distance of about 15 mm. After performing inflation and removing the adapter needle, the pressure of the air present in the bladder causes the edges of the hole formed in the rubber segment to close up, thus ensuring sealing of the bladder itself. To be sure of achieving this seal, two conditions are necessary: the needle must be introduced into the rubber segment axially, over the whole distance of 15 mm, and the pressure must be at least 0.8 bar. In the case where these conditions are not satisfied - for example because the needle has been inserted at an angle over a shorter distance, as may be easily done by mistake, or because the pressure inside the bladder is insufficient - the fibres of the rubber segment are unable to close again the hole produced by the needle, so that air is

gradually discharged from the inside towards the outside.

If the pressure is less than 0.8 bar at the end of a football match, in accordance with the regulations, the game is declared void, something which, in addition to being unfortunate per se, may also give rise to major crowd control problems, which are not uncommon in stadiums.

These and other drawbacks are brilliantly overcome by the present invention which proposes a safety valve for inflating playing balls, characterized in that it consists of a guide body which has an axial perforation widening out so as to form a valve seat, and a movable valve body which is subject to the action of means pushing it towards said valve seat and acting from the inside of the ball towards the outside.

According to a preferred embodiment, the guide body is made of a substantially rigid material, for example a synthetic material such as polyethylene, nylon or the like, or also metal. The valve body is in turn preferably made of rigid material and also has sealing means, consisting for example of an annular seal of the O-ring type, associated therewith.

Further characteristic features and advantages of the valve according to the present invention will in any case emerge more clearly from the following description of a preferred embodiment, illustrated in the accompanying drawings, in which:

Fig. 1 shows a cross-sectional view through the valve according to the invention, in the open position for allowing inflation of a ball; and

Fig. 2 shows a cross-sectional view through the same valve, in the closed position, so as to form a seal preventing the air from escaping from the ball.

The drawings show in very schematic form a cross-section through the bladder 1 of a ball and its inflating valve 2. This valve 2 is formed by a valve body 3 which is slidable inside a guide body 4. This

body 4 is joined to the inner surface of the bladder 1 in the manner which will be described in more detail hereinbelow.

According to the preferred embodiment, shown in the drawings, the bodies 3 and 4 are made of rigid synthetic material, such as polyethylene, nylon or any other plastic material, or also metal.

The body 3 of the valve 2 has a frustoconical head 6, which substantially matches the conical cavity of the guide body 4. The body 3 also has a peripheral annular groove 3a inside which a sealing ring 7 of the O-ring type is seated.



10 A cylindrical-shaped shank 8 projects from the bottom of the frustoconical head 6 and forms a guide for a pressure spring 10 which rests, on one side, against the bottom of the head 6 and, on the other side, on the bottom base-piece 9 for closing the guide body 4.



15 This guide body 4 is firmly connected to the inner surface of the bladder 1. To ensure an easier and more reliable connection, the body 4 extends at the top so as to form a widened plate 5 which is thinner at the periphery and which may be fixed, for example by means of bonding, welding or the like; an essential feature of the plate 5 is, therefore, that it should be made of a material which is suitable for this bonding or welding operation.

20 The guide body 4 of the valve 2 has a shaped axial perforation which comprises a widened cylindrical bottom section 4a, a conical middle section 4b, and a top section 4c consisting in a hole with a small diameter. A base-piece 9, which closes the axial perforation at the bottom end of the section 4a, has a through-hole 11 communicating with the interior of the ball bladder. Fixing of the base-piece 9 is performed, for example, by means of forced engagement, by bonding or by welding, for example also ultrasound or radiofrequency welding.

When it is required to perform inflation of the ball, it is possible to

place simply the nozzle P of a compressed-air gun against the hole 4c and introduce air under pressure. This air pressure is therefore sufficient to push the valve body 3 downwards against the opposing action of the spring 10. The valve is thus opened and the air supplied by the gun passes along  
5 the sides of the frustoconical head 6 of the valve body 3, between the latter and the conical wall 4b, and then underneath the shank 8 of said body 3, so as to enter into the bladder 1 through the through-hole 11. It is possible to continue inflating the ball up to the desired pressure.

As soon as the introduction of compressed air is interrupted, the  
10 body 3 returns upwards, pushed by the spring 10, and closes the air passage, with the head 6 making a perfect seal against the wall of the frustoconical section 4b owing to the seal 7.

As is obvious, the use of this valve is also much simpler than that of the known systems with a piercible segment; in fact, no special needle  
15 adapter is required, and a commonly used compressed-air gun may be directly applied.

On the other hand, it is important to avoid using this valve, by mistake, with a needle adapter of the known type (viewing the ball externally, it is normally not possible to recognise the new type of valve);  
20 such incorrect use, should the needle be inserted with excessive force, as normally occurs when it is assumed that one has to perforate a known piercible segment, could in fact result in breakage of the valve body 3. According to the present invention it is envisaged, for this purpose, that the section 4c should have a diameter which is smaller than the diameter of the  
25 needle of the known adapters so that it is entirely impossible to introduce such a needle.

Even though, for inflation of the ball, it is certainly simpler and faster to use the air gun directly as shown, it is still possible - and in any case remains within the protective scope of the present invention - to use the

conventional method with introduction of a needle S of an inflating adapter into the section 4c of the guide body 4 of the valve 2 (as schematically shown in broken lines in Fig. 1); in this case, however, it is necessary to use a special needle which has not only a diameter suitable for the section 4c of the body, but in particular a length such that it is able to rest against the valve body 3 and push it, against the force of the spring 10, until the shank 8 of the body 3 is brought up to the base-piece 9 of the guide body 4 (see Fig. 1), but not into contact with it, thus leaving open the air passage towards the bladder 1. The internal wall of the axial hole 4c in the guide body 4, since it is rigid, has the additional advantage that it prevents any possible deviation of the adapter needle which is thus obliged to follow an axial path.

Obviously, according to both the first and the second mode of use, it is still essential that the hole 4c should allow introduction of the needle of a pressure gauge, which is normally used to measure the internal pressure of the bladder. This needle will have a diameter which is suitable for the cross-section of the hole 4 and will also preferably be of a length such that it rests against the head 6 and displaces it by the right amount sufficient to open a small air passage.

It is also possible to envisage using a special tool, consisting of a connector body and a needle which has a calibrated cross-section and length in relation to the hole 4c; a tool of this type allows a pressure gauge of the conventional type to be engaged with or screwed onto the connector body - which is suitably shaped - and then the associated calibrated needle to be inserted into the hole 4c for the necessary measurements. However, a tool of this type could also certainly be used for the inflating operations, engaging a compressed-air gun or also a hand-pump onto the connector body.

As can be easily understood from the description above, the present

invention allows the inflation of balls of all types in a much simpler manner than that possible with traditional valves, ensuring at the same time a more reliable seal against pressure leakages, with obvious advantages, owing to the combined action of the spring 9 and the annular seal 6.

5           As already mentioned, in the present invention, reference has been made to a football only for the sake of simplicity of illustration, but it is obvious that the valve according to the present invention is also applicable to any other type of ball.

10           In an alternative embodiment, not shown, it is possible to manufacture the guide body 4 or the valve body 3 using magnetic material, the other of these two bodies being made of iron; in this way it is possible to achieve a force of attraction between the two bodies 3 and 4 which is sufficient to ensure the sealing action - obviously still in combination with the seal 7 - even without the use of the recall spring 10.

15           In a further variation of embodiment, however, it is possible to make the valve body 3 from synthetic or natural material which is relatively soft, for example natural or synthetic rubber; in this case, the seal 7 may no longer be necessary, since the body 3, already because of its nature, is able to ensure the necessary seal against the wall of the guide body 4.  
20           Moreover it is also possible to consider making the guide body 4 itself from a synthetic or natural rubber.

25           Finally, in yet another variation of embodiment, it is possible to associate with the inlet mouth 4c of the valve an additional disk element 12 delimiting the inflation hole; this disk element, which is shown only in broken lines, has the function:

- firstly, of effecting centring with respect to the hole in the wall of the ball, in order to prevent the bladder from being displaced in such a way that it hinders the inflating operation, and/or in order to facilitate the introduction of an inflating needle or the needle of a pressure gauge;



- secondly, when for example provided in a suitable distinctive colour, of helping distinguish the valve according to the present invention, which otherwise would not be immediately identifiable. This assists the operator who is immediately made aware of the existence of the new type of valve at the moment of inflation;

- finally, when made of a sufficiently rigid material provided with a small-diameter central hole, of also preventing the insertion, by mistake, of needles of the known art, as an alternative solution to the small-diameter hole 4c in the guide body 4.

Such an additional disk element may be made both as one piece with the guide body 4 or with the plate 5, when the latter are made from rigid material, or as a separate piece made of rigid material, in particular when the body 4 is made of soft material.

It is understood, however, that the invention is not limited to the particular embodiment which is illustrated above and which represents only a non-limiting example of realization of the invention, but that numerous variations are possible, all of which within the grasp of a person skilled in the art, without thereby departing from the protective scope of the invention itself. In particular, it should be noted that the valve body 3 need not necessarily have a conical shape, but may have any other suitable shape, for example a spherical or semi-spherical shape. Similarly, the base-piece 9 could also be configured differently, for example with an additional annular flange for ensuring more stable bonding to the bottom of the body 4.

CLAIMS

1. Safety valve for inflating playing balls used for sports and games, characterized in that it consists of a guide body (4) which has an axial perforation provided with a valve seat (4b), and a movable valve body (3) seated inside said axial perforation and subject to the action of means (10) pushing it towards said valve seat.
2. Safety valve according to Claim 1, characterized in that said valve seat (4b) consists of a conical section of said axial perforation and in that said valve body (3) has a head (6), the contour of which is sealingly applied against said valve seat (4b).
3. Safety valve according to Claim 1, characterized in that said head (6) of the valve body (3) has a conical shape, the profile of which substantially matches said conical section of the valve seat (4b).
4. Safety valve according to Claim 1, characterized in that said head (6) of the valve body (3) has a spherical or semi-spherical shape.
5. Safety valve according to any one of Claims 1 to 4, characterized in that said valve body (3) and/or said guide seat (4) are made from rigid material.
6. Safety valve according to Claim 5, characterized in that said rigid material is a synthetic material, such as polyethylene or nylon.
7. Safety valve according to Claim 5, characterized in that said rigid material is a metallic material.
8. Safety valve according to any one of the preceding claims, characterized in that sealing means (7) are arranged between said valve body (3) and said valve seat (4b).
9. Safety valve according to Claim 8, characterized in that said sealing means (7) consist of an annular seal of the O-ring type.
10. Safety valve according to any one of Claims 1 to 4, characterized in that said valve body (3) and/or said guide body (4) are

made of soft material.

11. Safety valve according to Claim 10, characterized in that said soft material is a synthetic or natural rubber.

12. Safety valve according to Claim 10 or 11, characterized in that said valve body (3) made of soft material directly forms a seal on said valve seat (4b).

13. Safety valve according to Claim 1, characterized in that said thrusting means (10) consist of a pressure spring (10).

14. Safety valve according to Claim 13, characterized in that said pressure spring (10) rests, on one side, against the valve body (3) and, on the other side, against a base-piece (9) closing the bottom end of said axial perforation, said pressure spring (10) being guided on a guide shank (8) forming an extension of said valve body (3).

15. Safety valve according to Claim 1, characterized in that said thrusting means (10) consist of magnetic attraction means.

16. Safety valve according to Claim 15, characterized in that said magnetic attraction means comprise a guide body (4) made of magnetic material and a valve body (3) made of ferromagnetic material, or vice versa.

17. Safety valve according to any one of the preceding claims, characterized in that said axial perforation is formed by an inlet section in the form of a hole (4c) with a small diameter, a middle section (4) for seating the head (6) of the valve body (3), and a bottom section (4a) for seating the pressure means, said hole of the inlet section coinciding with a hole in the bladder and/or in the ball casing.

18. Safety valve according to Claim 17, characterized in that said inlet section has a diameter which is smaller than the diameter of a needle of an inflating adapter according to the known art.

19. Safety valve according to Claim 17, characterized in that the bottom end of said axial perforation is closed by a retaining base-piece (9)

which has a through-hole (11).

20. Safety valve according to Claim 1, characterized in that said guide body (4) extends, at its top end, so as to form a widened plate for joining to the inner surface of the bladder (1) of the ball.

5           21. Safety valve according to Claim 1 or 20, characterized in that a centring and guiding disk element (12) is associated with said top end of the guide body (4).

22. Safety valve according to Claim 21, characterized in that said centring and guiding disk element (12) is made of rigid material.

10           23. Safety valve according to Claim 21 or 22, characterized in that said centring and guiding disk element (12) is made as one piece with said guide body (4).

24. Safety valve according to Claim 21 or 22, characterized in that said centring and guiding disk element (12) is provided with a distinguishing  
15 colour.

25. Ball for games and/or sports, characterized in that it is provided with a safety valve according to any of the preceding claims.

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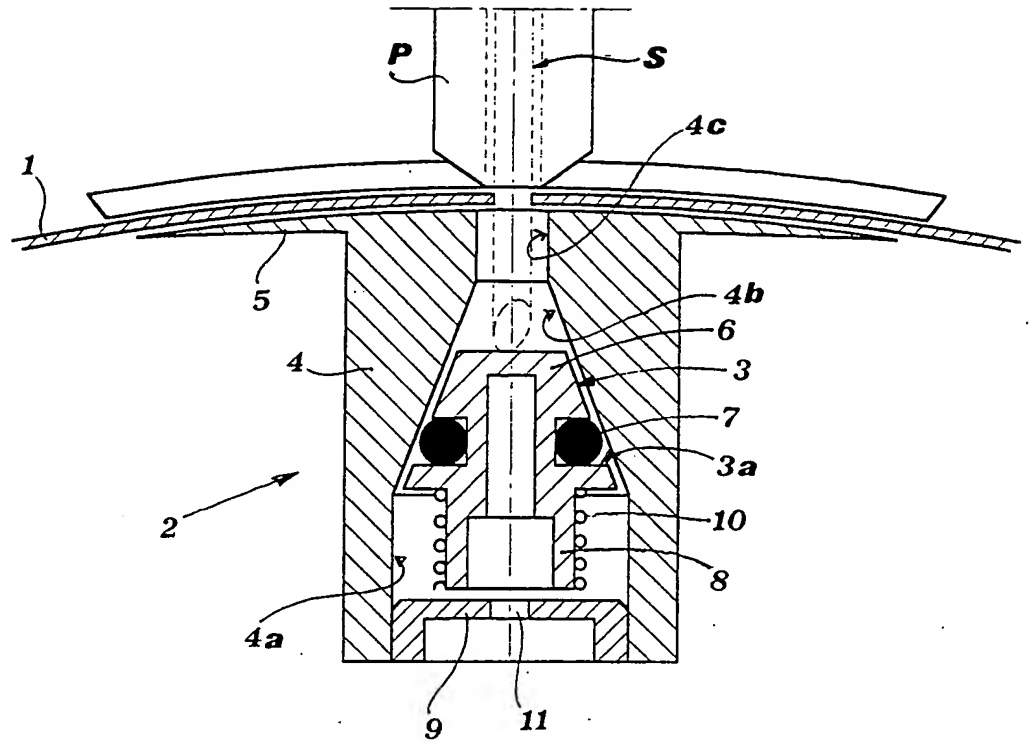


FIG.1

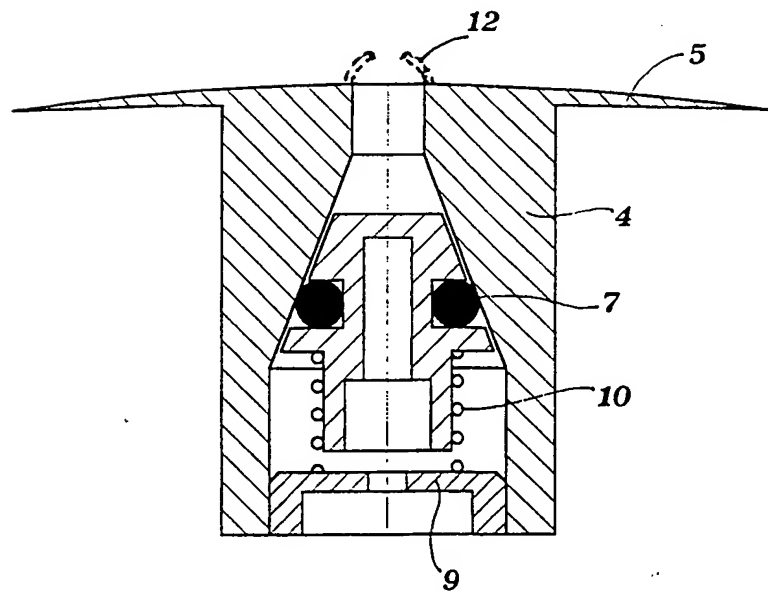


FIG.2

# INTERNATIONAL SEARCH REPORT

In. ational Application No  
PCT/IB 98/01871

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 F16K15/20 F16K31/08

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)  
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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 399 547 C (LAXY ALBERT) 4 August 1924  see page 2, line 5 - line 24; figure 1	1-3,5,7, 8,13,25
X	US 1 590 173 A (ANGLADE PROSPER EUGÈNE A.) 22 June 1926  see the whole document	1,2,4, 10-13, 17-20,25
A	FR 1 239 489 A (DAMIC CONTROLS LTD.) 15 September 1959 see page 2, left-hand column; figure	1-3,5, 7-9,13
A	DE 10 27 949 B (WIESE KONRAD) 10 April 1958  see column 2, line 36 - line 54; figure 1	1-3, 10-12, 20,25
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Date of the actual completion of the international search

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Date of mailing of the international search report

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 744 858 A (GIRDLESTONE PUMPS LTD) 15 February 1956 see page 2, line 12 - line 34; figure 1 -----	1, 4, 6, 15, 16

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 98/01871

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 399547	C	NONE	
US 1590173	A	22-06-1926	NONE
FR 1239489	A	NONE	
DE 1027949	B	NONE	
GB 744858	A	NONE	

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